ECE 345 / ME 380: Introduction to Control Systems
Collaborative Quiz #4 Grading Sheet

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This quiz is open-note and open-book. Computational tools (Matlab, calculators) are allowed. No partial credit will be awarded. For each of the questions, clearly write the correct answer.

In-Class Questions

$T_s \leq 8 \quad e_{ss} = \frac{1}{K} \leq \frac{1}{10} \quad K \geq 10$ ✓

$s^2 + ps + K \Rightarrow s^2 + 2\zeta\omega_n s + \omega_n^2$

$2\zeta\omega_n = p \quad \omega_n^2 = K \quad \omega_n = \sqrt{K}$

$\zeta = \frac{p}{2\sqrt{K}}$

1. B

$T_s = \frac{4}{\zeta\omega_n} = \frac{4}{\frac{p}{2}} = \frac{8}{p} = 4 \leq 8$ ✓ $\quad \omega_n = \sqrt{16} = 4$

2. B

3. yes, K=16, p=2 will satisfy both T_s and steadystate ↑

4. yes, the plot show marginal stablibity because it converges to a non-zero constant.

5. A

$\frac{\frac{1}{s(s+p)}}{1+K\frac{1}{s+p}} \frac{1}{s} = Y(s) = \frac{1}{s(s^2+ps+k)}$

Statement of Effort

$\lim_{s \to 0} sY(s) = s\left(\frac{1}{s(s^2+ps+k)}\right) \quad y_{ss} = \frac{1}{K}$

By signing below, I pledge that I have written this quiz as per the indicated instructions, and fully participated in the group.

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Collaborative Quiz #4

Location of poles and zeros of G(s)

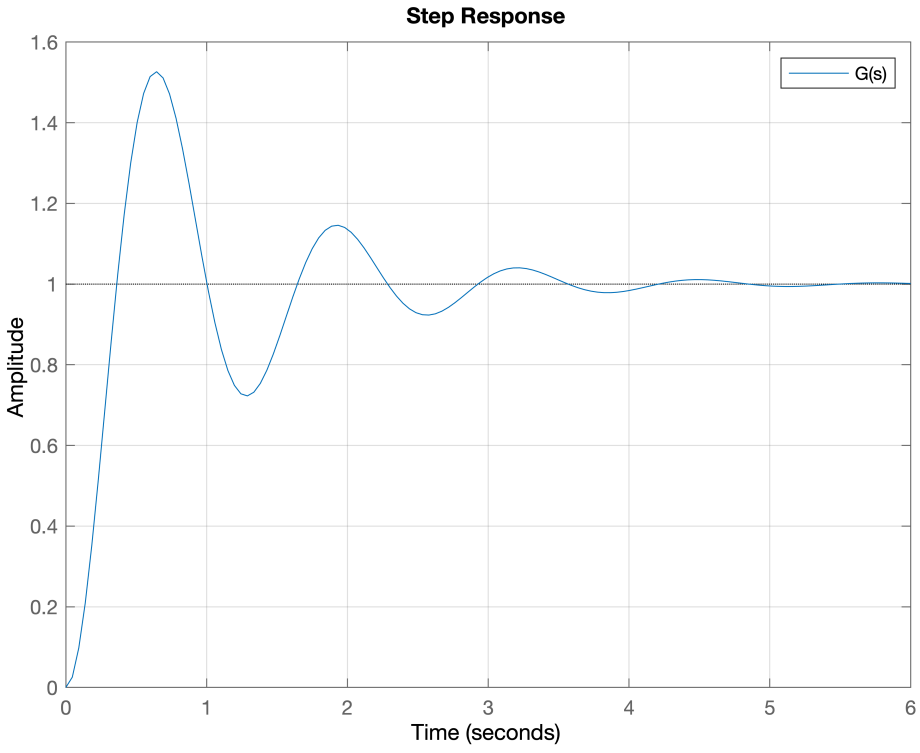
```
num=[25]; den=[1 2 25];
```

Step response of the open-loop system

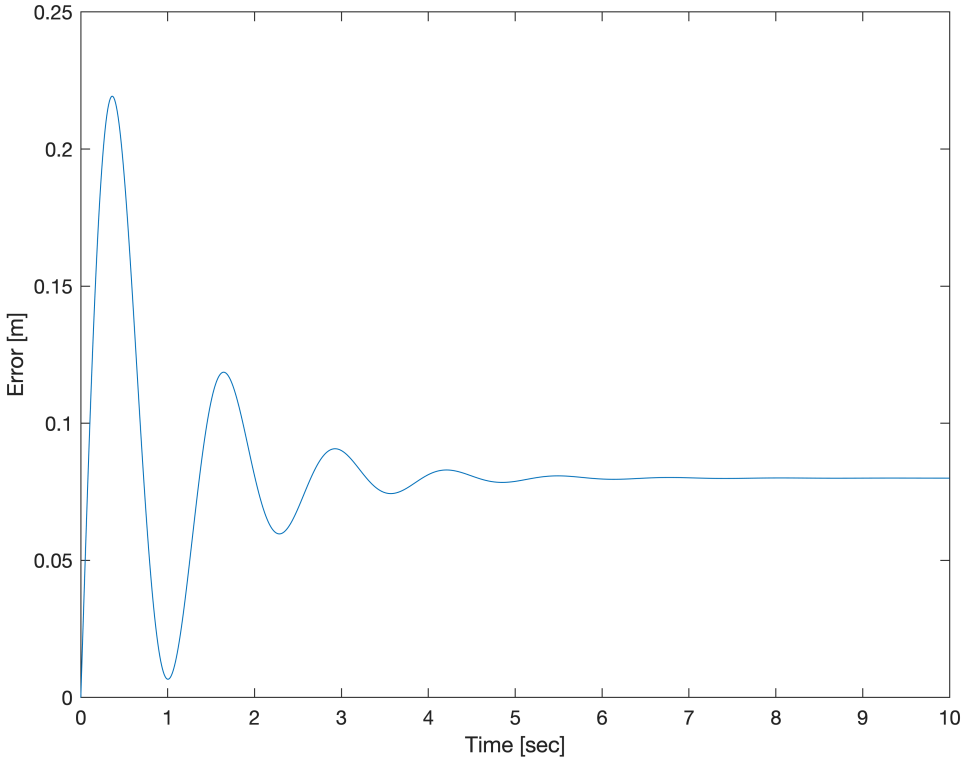
```
sys=tf(num,den)
```

```
sys =

        25
  --------------
  s^2 + 2 s + 25

Continuous-time transfer function.
```

```
step(sys);grid;legend('G(s)','location','northeast')
```




```
t = 0:.01:10;
r = t;
[y,tout] = lsim(sys,r,t);
plot(tout, r'-y);
xlabel('Time [sec]'); ylabel('Error [m]');
```


0.25
0.2
0.15
0.1
0.05
0
Error [m]
0
1
2
3
4
5
6
7
8
9
10
Time [sec]